

REMARKS

Applicant respectfully requests reconsideration and allowance of all pending claims.

I. Status of Pending Claims

Claims 1-102 remain pending in the present application. Claims 1-3, 59, 60, and 68 have been amended. Support for the amendments to the claims may be found in the specification, for example, at Figures 2, 3, and 6 and in paragraph 0034.

II. Amendments to the Specification

Paragraph 0034 of the specification, which is at page 13, lines 5 ff of the specification as filed, has been amended to express what is shown in the crucible (Figs. 2 and 3), namely, that the feeding is "out of the feed tube 42" and onto the exposed unmelted polysilicon.

III. § 102(b) Rejection of Claims 1-3

Reconsideration is requested of the rejection of claims 1 through 3 as being anticipated by Nagai et al. (U.S. 5,902,395).

Applicant's claim 1 has been amended to clarify that the feeding is "intermittently delivering the additional polysilicon out of a feed tube in the crucible and onto the exposed portion of the unmelted polysilicon." This amendment underscores a distinction between the process of claim 1 and the process disclosed by Nagai et al., namely, that applicant intermittently delivers polysilicon out of his feed pipe. Moreover, this amendment eliminates the concern stated on page 11 of the Office action that applicant's intermittent feeding onto the exposed portion of unmelted polysilicon reads on unmelted polysilicon in Nagai et al.'s feed tube.

As noted on page 10 of the Office action, Nagai et al. disclose intermittent feeding of silicon into their feed pipe.

That their intermittent feeding is from their feeder (3 in Fig. 3) into their feed pipe (4 in Fig. 3) is emphasized by Nagai et al.:

Commencement and stoppage of feeding of the granular silicon material *from the feeder to the feed pipe* are repeated so as to maintain stagnation of the granular silicon material in the feed pipe. Nagai et al.; col. 3, line 54.

At this time, commencement and stoppage of supply of the granular silicon material from the *vibration feeder to the feed pipe* were controlled by Nagai et al.; col. 9, line 38.

... repeating commencement and stoppage of feeding of the granular silicon material *from the feeder to the feed pipe* so as to maintain stagnation of the granular silicon material in the feed pipe.... Nagai et al.; claim 1.

And it is evident from Nagai et al.'s figures that their feeder 3 (Fig. 3) and 16 (Fig. 5) which intermittently discharges polysilicon is *not* in their crucible.

Accordingly, Nagai et al. do not disclose or suggest that any intermittent feeding is *out of a feed pipe in the crucible*. To the contrary, Nagai et al. achieve *continuous* feeding out of their feed pipe onto the melt because their stagnation in their feed pipe provides a constant supply of polysilicon. Their combination of a) stagnation in the feed pipe, and b) crucible rotation achieve their specific goals of *continuous* feeding:

However, rotation of the crucible makes it possible to continuously feed the granular silicon to the unmolten layer. (Nagai et al.; col. 6, line 8).

As a result, it is possible to continuously feed the granular silicon to the unmolten layer. (Nagai et al.; col. 6, line 64).

It is therefore evident that Nagai et al. do not disclose or suggest the express requirement of applicant's claim 1 of "intermittently delivering the additional polycrystalline silicon out of a feed tube in the crucible and onto the exposed portion of the unmelted polycrystalline silicon." Their process does not intermittently deliver polysilicon out of their feed pipe in their crucible. This is an express requirement of claim 1 which cannot be ignored when assessing patentability. And not only do Nagai et al. fail to disclose this requirement, they specifically teach away from this requirement by teaching a process which achieves "continuously feed[ing] the granular silicon to the unmolten layer." (Nagai et al.; col. 6, line 8). The subject matter of claim 1, therefore, is not anticipated by Nagai et al.

Applicant's claims 2 and 3 similarly require "intermittently delivering the additional polycrystalline silicon out of a feed tube in the crucible and onto the exposed portion of the unmelted polycrystalline silicon," such that these claims are similarly patentable over Nagai et al.

The foregoing literal distinctions between the respective processes are not simply semantic. Rather, they are germane to the fundamental contrasting goals achieved by the respective processes:

applicant's intermittent feeding directly onto the melt to "decrease the amount of time required to prepare a fully molten silicon melt compared to a continuous feeding method"¹

versus

Nagai et al.'s intermittent feeding into a feed pipe to yield stagnation making it "possible to continuously feed the granular silicon to the unmolten layer."²

¹ Applicant's specification; paragraph 28, page 10, line 18.

² Nagai et al.; col. 6, line 64.

In view of the above, applicant requests that the anticipation rejection be withdrawn.

IV. §103(a) rejections of Claims 1-102

A. Nagai et al. (U.S. 5,902,395) in view of Holder (U.S. 5,588,993)

Reconsideration is requested of the rejection of claims 1-102 as being obvious over Nagai et al. (U.S. 5,902,395) in view of Holder (U.S. 5,588,993).

Each of claims 1-102 is or depends from a claim which expressly requires "intermittently delivering the additional polycrystalline silicon out of a feed tube in the crucible and onto the exposed portion of the unmelted polycrystalline silicon of said partially melted charge in the crucible." Nagai et al. fail to disclose or suggest this, and moreover teach away from this, as described above. Holder et al. also fail to disclose or suggest this, and in fact was cited only for its disclosure of feeding fresh polysilicon onto unmelted polysilicon to facilitate dehydrogenation. Accordingly, these claims are all patentable over the cited combination for the same reasons as stated above with regard to the 102 rejection, and by virtue of the additional requirements therein.

B. Holder (U.S. 5,588,993) in view of Kamio et al. (U.S. 5,087,429)

Reconsideration is requested of the rejection of claims 1-102 as being obvious over Holder (U.S. 5,588,993) in view of Kamio et al. (U.S. 5,087,429).

Each of claims 1-102 is or depends from a claim which expressly requires "intermittently delivering the additional polycrystalline silicon out of a feed tube in the crucible and onto the exposed portion of the unmelted polycrystalline silicon of said partially melted charge in the crucible." Holder et al.

fail to disclose or suggest this, as acknowledged on page 7 of the Office action.

To compensate for this failure of the Holder et al. reference, the Kamio et al. reference was cited because it refers to intermittent feeding. However, the Kamio et al. reference states that continuous or intermittent feeding had been employed "so as to maintain constant the liquid level of the molten material." Kamio et al.; col. 1, line 58. This intermittent feeding is described as an option in the context of Kamio et al.'s process involving pulling of single crystal silicon while *simultaneously* feeding fresh solid polysilicon to replace the single crystal mass being removed by pulling:

Thus, in accordance with the present invention there is provided a silicon single crystal manufacturing method in which a crucible containing molten silicon is divided into an inside single crystal growing section and an outside material feeding section to allow the molten silicon to move gently and a silicon single crystal is pulled from the single crystal growing section while continuously feeding silicon starting material Kamio et al.; col. 4, line 60 ff.

In sharp contrast, the Holder et al. patent is directed to a fundamentally different process wherein the complete silicon melt is formed, feeding is terminated, and only then is a crystal pulled:

After the feeding of granular-polycrystalline silicon 40 is complete, the feed tube 42 can be positioned away from the center of the crucible 20 to allow for crystal pulling. Holder et al.; col. 7, line 11 ff.

Accordingly, the Kamio et al. process is continuous wherein pulling and replenishing are simultaneous, so that it is desirable to "maintain constant the liquid level of the molten material." But the Holder et al. process involves completing a melt, removing the feed pipe, then pulling a crystal; so there is no simultaneous pulling and replenishing. That is, the Holder et

al. process involves a) *continuously raising* the liquid level during melt formation, and b) *continuously lowering* the liquid level during crystal pulling. The liquid level dynamics in the two processes are opposite.

Most significantly, therefore, because Kamio et al. refer to intermittent feeding only as a way in which others had achieved a) constant liquid levels, in b) a simultaneous pulling and replenishing operation, there is no motivation to modify the Holder et al. process by incorporating this intermittent feature. Holder et al.'s process does not employ constant liquid levels, nor does it involve simultaneous pulling and replenishing. With this motivation lacking, the MPEP emphasizes that there is no *prima facie* case of obviousness:

First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. MPEP 2143, first paragraph.

Furthermore, in the context of a §103(a) obviousness-based rejection,

It is improper to combine references where the references teach away from their combination. *In re Grasselli*, 713 F.2d 731, 743, 218 USPQ 769, 779 (Fed. Cir. 1983).
MPEP 2145.X.D.2

Here, it is improper to make the proposed combination because Holder et al.'s process involves completing a melt, removing the feed pipe, then pulling a crystal; in contrast to Kamio et al.'s discussion, which relates to simultaneously pulling and replenishing. And the "intermittent" aspect discussed by Kamio et al. specifically relates to achieving this simultaneous pulling and replenishing. By disclosing that intermittent feeding had been considered useful for maintaining a constant liquid

level required for continuous pulling and replenishing, therefore, Kamio et al. teaches away from combination of this aspect into the Holder et al. process.

While the foregoing establishes that there is no *prima facie* obviousness because the proposed modification is not motivated, it is also significant that, taken as a whole, the Kamio et al. reference cannot fairly be held to teach intermittent feeding because it teaches away from intermittent feeding. In the context of a §103(a) rejection, the MPEP warns:

A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention. *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), cert. denied, 469 U.S. 851 (1984). MPEP 2141.02, last paragraph.

Taken as a whole, as it must be in an obviousness analysis, the Kamio et al. reference teaches away from intermittent feeding and therefore cannot properly be cited as teaching intermittent feeding. For example, in the paragraph immediately following the Office's citation in the Kamio et al. reference, the reference states "these methods [referring to the methods cited which may use intermittent feeding] have not been put in practical use due to their technical difficulties encountered." Col. 2, lines 10-11. Therefore, the Kamio et al. reference, after mentioning intermittent feeding processes, expressly disclaims their use due to "their technical difficulties." Beyond this passing reference in their Background, the Kamio et al. reference does not mention intermittent feeding again, and certainly not in the context of a recommendation or even a viable alternative. Conversely, the reference refers to continuous feeding in several locations throughout its disclosure, including:

It is a primary object of the invention to provide a method and apparatus for manufacturing silicon single crystals by

continuously feeding silicon starting material... Summary of the Invention, Col. 4, lines 47-51, emphasis added.

...and a silicon single crystal is pulled from the single crystal growing section while continuously feeding silicon starting material... Summary of the Invention, Col. 4, lines 65-67, emphasis added.

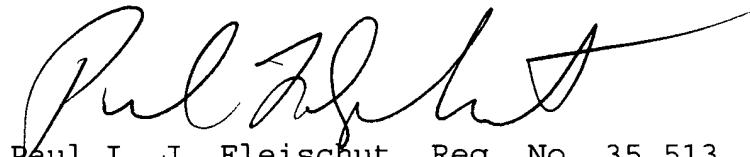
See also Col. 7, lines 22-25, Col. 8, lines 8-17, Col. 8, lines 8-1754-58, Col. 11, lines 15-19, Col. 11, lines 57-61, and Col. 12, lines 5-17. In light of this whole disclosure, the Kamio et al. reference teaches away from intermittent feeding and therefore cannot properly be relied on as teaching intermittent feeding. Because Holder fails to correct this deficiency, the combination of references fails to teach or suggest the invention defined by claims 1-102 including its requirement of intermittent feeding. Accordingly, these claims are patentable over the combination of references, and applicant requests that the rejection be withdrawn.

Conclusion

In view of the above, favorable reconsideration and allowance of all pending claims is respectfully requested.

A check in the amount of \$120.00 is enclosed in payment of the one-month extension of time fee for the filing of this response. The Commissioner is also authorized to charge any fee deficiency or credit any overpayment to Deposit Account No. 19-1345.

Respectfully submitted,



Paul I. J. Fleischut, Reg. No. 35,513
SENNIGER POWERS
One Metropolitan Square, 16th Floor
St. Louis, Missouri 63102
(314) 231-5400

PIF/NAK/clh

Express Mail Label No. EV 504799409 US
Mail Stop Amendment